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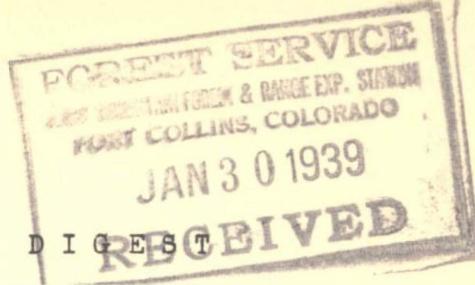
FOREST RESEARCH DIGEST

WINTER 1939



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LAKE STATES FOREST EXPERIMENT STATION^{1/}

FOREST SERVICE

U. S. DEPT. AGR.

FOREST SURVEY PAINTS AN ENCOURAGING PICTURE

There is 60 percent more saw timber in the Lake States region than was shown on previous estimates, according to the Forest Survey figures recently released by the Lake States Forest Experiment Station in its Economic Notes, No. 10.

The total timber volume as presented in the report is 57.6 billion board feet as compared with a rough estimate of 35.8 billion made 1931. The new saw-timber estimate by species groups is shown in the following table:

Volume of saw timber in the Lake States in millions of board feet
(International $\frac{1}{4}$ -inch scale)

State	All species	Pine	Hem-lock	Other soft-woods	Maple, basswood, y. birch, beech	Aspen	Other hard-woods
Minnesota.....	12,455	4,859	1,728	851	2,367	2,650
Wisconsin.....	16,612	1,684	2,672	353	5,195	804	5,904
Michigan.....	28,549	1,366	6,550	1,668	13,280	955	4,730
Region.....	57,616	7,909	9,222	3,749	19,326	4,126	1,284

Michigan has 50 percent of the total saw-timber volume.

It has 71 percent of the hemlock, 72 percent of the yellow birch, 70 percent of the sugar maple, and 89 percent of the beech.

Wisconsin has 31 percent of the forest land but only 29 percent of the saw timber and 20 percent of the pulpwood.

^{1/}Maintained in cooperation with the University of Minnesota at University Farm, St. Paul, Minnesota.

Minnesota has much less of the valuable hardwoods than Wisconsin and Michigan but has 67 percent of the white and red pine saw timber, 62 percent of the spruce pulpwood, and 75 percent of the jack pine pulpwood.

The inventory, while more encouraging than previous estimates, shows a relatively small volume of merchantable timber for such a large acreage of forest land. The average stand is only 635 board feet per acre.

The estimates as given are much higher than ordinary private cruises. Saw timber has been estimated in trees down to 9 inches d.b.h. and to a 6- and 8-inch top. Volumes are expressed in lumber tally, which overruns the Scribner scale about 15 percent. Volume has been estimated not only in concentrated marketable stands but on cutover lands as well. It includes some permanently inaccessible timber and some species at present not salable. The inventory should be very carefully analyzed, therefore, before any conclusions are drawn as to the amount of merchantable timber available for commercial use in the immediate future.

WISCONSIN'S FARM CONSUMPTION OF FENCE POSTS LARGEST IN LAKE STATES

More fence posts are used annually on Wisconsin farms than in Minnesota or Michigan, according to findings of the Forest Survey just completed by the Lake States Forest Experiment Station. About 15,865,000 posts are required each year to keep 424,625 miles of fence in repair. Annual replacements in Minnesota have been estimated at 11 million, Michigan 7,844,000.

Over 160 million posts are now in use in Wisconsin. Of these 94.1 percent are wooden posts, 5.9 percent steel or

concrete. White cedar, white and red oak, in the order named, are the principal species of wood in use.

Fence posts used on Wisconsin farms, by material

Species or construction material	Posts in use		Annual replacements	
	M pieces	Percent	M pieces	Percent
White cedar.....	52,695	32.9	3,100	19.5
White oak.....	52,104	32.5	4,737	29.9
Red oak.....	33,223	20.7	5,537	34.9
Tamarack.....	3,697	2.3	370	2.3
Jack pine.....	2,077	1.3	346	2.2
Elm.....	1,650	1.0	275	1.7
Miscellaneous hardwoods.....	4,126	2.6	825	5.2
Miscellaneous conifers.....	1,195	0.8	199	1.3
Steel.....	9,475	5.9	474	3.0
Concrete.....	33		2	
Totals.....	160,275	100.0	15,865	100.0

In the replacements the oaks are gaining in relative importance because of the growing shortage of white cedar near the farming areas. Use of steel posts is also increasing, about twice as many steel posts being set each year as would be required to maintain the present mileage of steel fence. Increasing use of electric fence, which uses fewer and smaller posts, was also noted, and this in time will doubtless be reflected in lower annual post requirements.

The Survey showed that in 1937 about 30.3 percent of the wooden posts in Wisconsin were cut from saw-log trees, some fairly good saw logs being split for posts; 55.3 percent came from good cordwood trees 5 to 9 inches in diameter; 2.5 percent came from saplings below 5 inches in diameter; 11.9 percent were obtained from dead trees or other wood waste.

Of the wooden posts used in Wisconsin 92.8 percent, or 14,716,000, are produced on farms. At an average value of 15

cents each, this crop is worth \$2,207,400 annually to the farmers.

A COMMERCIAL SELECTIVE CUTTING IN HEMLOCK-HARDWOODS

An example of the results of a selective cutting in the hemlock-hardwood type is analyzed in an article by Duerr and Stoddard in the December 1938 issue of the Journal of Forestry. An 80-acre tract in Oconto County, Wisconsin, was cut over selectively by the Holt Lumber Company in 1925—one of the first operations of this kind in the region. Remeasured after 12 years, the residual stand was found to have increased in net volume at the rate of 267 board feet per acre per year. Value increase had amounted to \$1.13 per acre per year. The following table summarizes the findings of the study:

Number of merchantable trees, volume, and value on the average acre of the Holt tract at various stages in the selective-cutting cycle

D.b.h. class (inches)	Immediately before cutting			Removed in cutting		
	Trees	Volume	Value	Trees	Volume	Value
10-12	66.1	2,348	5.12	8.0	272	0.41
14-16	33.5	3,412	11.27	7.7	843	3.10
18-20	13.2	2,813	14.35	6.9	1,510	9.55
22-24	3.6	1,292	7.68	2.9	1,056	7.26
26-28	2.2	1,271	5.61	2.2	1,271	5.61
30+	1.4	1,193	4.42	1.4	1,193	4.42
Total	120.0	12,329	48.45	29.1	6,145	30.35
	Immediately after cutting			12 years after cutting		
10-12	58.1	2,076	4.71	60.8	2,124	4.49
14-16	25.8	2,569	8.17	40.7	4,029	12.29
18-20	6.3	1,303	4.80	12.5	2,663	11.56
22-24	.7	236	.42	1.5	568	3.36
Total	90.9	6,184	18.10	115.5	9,384	31.70

About two thirds of the volume in the original stand was hemlock; the other third, a mixture of yellow birch, sugar maple,

and other hardwoods. The selective cutting opened up the stand sufficiently to allow abundant reproduction, which was nearly all of hardwood species. At the time of the 12-year remeasurement there were 2,400 stems per acre between 2 feet high and 2 inches d.b.h.

Mortality during the 12 years after logging was low: the annual average being less than 1 percent of the number of trees 2 inches and larger d.b.h. In terms of saw timber, mortality was 32 board feet per acre per year, or 12 percent of the growth. Among trees 6 inches and larger d.b.h., 21 percent of the mortality resulted from windthrow; 35 percent, from logging damage; and 44 percent, from drought, suppression, and other causes.

Fifty percent of the saw-log volume was taken in the selective cutting. The value of the trees taken, because of their larger size and better grade, was 63 percent of that for the entire stand. Similarly, residual volume was increased 52 percent in the 12 years after logging, while value increased 75 percent. The increase in value from \$18.10 to \$31.70 per acre, after deduction of carrying charges and taxes (under the Wisconsin Forest Crop Law), represents a net annual return of $\frac{3}{4}$ percent on the residual investment.

MINNESOTA PAPER COMPANY TRIES SELECTIVE LOGGING

C. B. Stott, R-9

A trial of selective-cutting methods on a stand of 48-year-old jack pine running 25 cords to the acre was made last winter on a paper company operation near Thistledew Lake in Itasca County, Minnesota. The project was set up as an experiment and was carried out jointly by the Minnesota State Forest Service, the paper company, and the United States Forest Service. The

timber was cut from state land by a local jobber and rail-hauled to International Falls. Felling and bucking was done by the piece, and the other operations, including skidding and hauling, on a monthly basis of pay. The cutting was on a commercial scale removing a total of 1,519 cords of pulpwood.

The purpose of the experiment was to determine what, if any, additional costs were involved in logging jack pine on a partial-cut basis. Therefore, intensive cost records were kept on each of four adjacent areas where four degrees of selective cutting were tried. These removed 30, 40, 60, and 100 percent of the commercial volume. The costs as computed by the paper company are shown in the following table:

Preliminary cost summary, jack pine selective cutting

Item	30 percent cut	40 percent cut	60 percent cut	100 percent cut
Area cut over..... acres	55	40	25	16
Volume marked for removal..... cords	1/ 361	1/ 356	1/ 370	2/ 380
Volume removed..... cords	363	366	352	2/ 438
Contract price for logging..... per cord	\$5.50	\$5.50	\$5.50	\$5.50
Total logging cost to jobber..... per cord	4.69	4.55	4.58	4.69
Net realiza- tion..... per cord	\$.81	\$.95	\$.92	\$.81
Additional logging costs to company.....	\$3.61	\$3.61	\$3.61	\$3.61
Total cost of logging by company and jobber..... per cord	8.30	8.16	8.19	8.30
Forester's cost of timber marking.....	.21	.24	.14
Total cost.....	\$8.51	\$8.40	\$8.33	\$8.30

1/ Tally made during marking. 2/ Estimate made before marking.

2/ Includes trees between 4.2 and 4.9 inches which were clear cut, but which were not considered in the original estimate made before marking.

The records indicate that with the lightest cut (30 percent) the cost per cord was about \$.21 more than in a clear-cutting operation. This was due entirely to the cost of timber marking. The cost of marking is perhaps higher than it would be on a larger operation after the superintendent and forester had had more experience with the work.

The 40-percent selective cut cost \$.10 per cord more than clear-cutting. The actual cost of the operation, exclusive of marking cost, however, was \$.14 less.

The cost per cord with 60-percent selective cut was but \$.03 greater than with the clear-cut method.

The experiment demonstrates that under conditions such as found in parts of northern Minnesota, Jack pine pulpwood stands in the 45- to 50-year age class can be cut selectively with little, if any, additional cost insofar as the woods operation is concerned.

FOREST OPERATIONS OF A WISCONSIN LUMBER COMPANY

W. S. Bromley, R-9

The stand of virgin northern hardwood timber which is owned by a lumber company in northeastern Wisconsin represents one of the largest remnants of the original forest in the state. This timber and that of adjoining property holders was covered by an extensive survey by the Forest Service in 1936. The survey disclosed the following facts:

Total area.....	151,910 acres
Virgin timber.....	24,093 acres
Selectively cut area.....	17,515 acres
Total volume.....	355,840,000 bd. ft.
Potential annual yield.....	12,000,000 bd. ft.

The company has been carrying two types of cutting: selective cutting and clear-cutting. In order to manage the area for permanent sustained yields it will be necessary to reduce the annual cut from the present average of 16 million board feet to about 12 million board feet per year.

Average cost and return from two types of cutting

Item	Clear-cutting in 20 years	50-percent selective cutting, sustained yield
	M ft. b.m.	M ft. b.m.
Annual cut - (mill scale).....	24,554	13,932
(log scale).....	20,445	12,000
	Per M	Per M
Operating costs of logging, log scale.....	\$ 10.18	\$ 10.58
Overrun.....	20.1%	16.1%
Cost of logging, mill scale....	\$ 8.48	\$ 9.11
Operating cost of milling, mill scale (not including depreciation).....	15.15	17.32
Total operating cost of production.....	\$ 23.07	\$ 25.66
Revenue received, mill scale...	35.98	39.93
Gross realization per M, mill scale (before depreciation, depletion, etc.).....	\$ 12.91	\$ 14.27
Total annual gross realization.....	\$316,992	\$198,810

By reducing all the annual income to a present worth basis at a risk-free rate of interest (3 percent), after all income taxes and other reductions are made, the following values are indicated:

	Theoretical present worth (At risk-free rate of 3 percent)	Practical present worth (After allowing for all risks)
Liquidation in 20 years.....	\$4,013,877	\$2,771,128
Sustained yield.....	4,646,103	2,665,661

This analysis shows that a selective logging for sustained yield will return nearly \$4 per thousand more than clear-cutting in 20 years due to the greater value of the large trees. Operating costs, particularly in the mill, will be greater so that the difference in gross realization will be but \$1.36 in favor of selective logging.

The present worth of all timber after allowing for risks is slightly greater under the clear-cutting plan. However, other advantages such as greater stability of operation, smaller depreciation on mill and machinery, and a few other less tangible items tip the scales in favor of selective logging.

FOREST INDUSTRIES OF MARATHON COUNTY, WISCONSIN

E. L. Lawson, Minn. State Conservation Dept.

The inventory of wood-using industries which has been made as a part of the Lake States forest survey has uncovered some very interesting local situations. One area which is unusual for the number and variety of wood conversion plants is Marathon County, Wisconsin.

Marathon County, of which Wausau is the county seat and principal city, lies practically in the center of the state. It is essentially an agricultural county but a sufficient area of woodland remains within and adjacent to the farms to sustain production of a substantial volume of forest products.

The largest industries are the 3 pulp mills located at Brokaw, Mosinee, and Rothschild. These mills consumed about 175,000 cords of pulpwood in 1936 and about the same in 1937. About 13 percent of total requirements are furnished by farmers within a 50-mile radius. Forty-two percent of the pulpwood used in 1936 came from other localities in Wisconsin, 36 percent came from Michigan, 8 percent from Minnesota, and 1 percent from Canada. In 1937, over 13 percent was obtained from Canada, and increased importation is expected in the future. There is danger that some of the mills may move to locations closer to large pulpwood supplies.

There are 65 sawmills within Marathon County, of which 24 are stationary mills with sawing capacity ranging from 2,000 to 40,000 board feet per day. Forty-one are portable or semi-portable mills of small size. In 1936 the total sawmill production was about 30 million feet, board measure--somewhat above normal. Approximately half the wood for these mills is obtained from woodland within the county.

Apparently there is little future for large sawmills in Marathon County. Logs for the Schofield mill, the largest mill in the county, are obtained chiefly from Lincoln County, only 4 or 5 percent being obtained locally. The Athens mill is scheduled to close soon, after operating continuously for 50 years. The fate of the smaller mills is tied up with the management of the farm wood lots and scattered tracts of second growth which remain in the county. If 100,000 acres of woodland by better management can be made to yield an average of 130 board feet per acre annually, this group of small mills can be supported on a permanent basis. Eventually the woodlands should be able to yield much more.

In addition to pulp mills and sawmills, there are 3 shingle mills, 2 lath mills, 1 turning mill, 2 cheesebox factories, and 1 veneer mill.

The combined wood consumption of sawmills, pulp mills, and other industries in 1936 was 120 million feet, board measure.

About one fourth of this was drawn from local sources.

Volume of saw timber used in Marathon County—1936

Mills	Volume used, 1936	Volume produced on farm forests within county, 1936	Volume produced on commercial forests within county, 1936
	<u>M bd. ft.</u>	<u>M bd. ft.</u>	<u>M bd. ft.</u>
Pulpmills.....	80,000	2,000	1,000
Sawmills.....	30,000	14,000	10,000
All other.....	10,000	5,000	1,000
Total.....	120,000	21,000	12,000

The forest industries are an important source of employment. In 1936, primary wood-using industries in the county gave part-time or year-round jobs to over 1,000 men for an average of 180 days. Including workers in paper mills and other secondary industries as well as employment in the woods, it is certain that several thousand more men obtain a part or all of their livelihood from forest work. In Wausau nearly 2,700 persons or 65 percent of all industrial employees have been credited to lumber and paper trade. Forest products are also an important source of income for farmers. The 1929 census showed Marathon County to rank first in Wisconsin in farm production of both saw logs and pulpwood. The value of the wood cut averaged \$210 per farm.

Thus in Marathon County it is obvious that forest industries are of sufficient importance to justify sustained interest in forest conservation on the part of all people in the area.

OPENING OF JACK PINE CONES AT DIFFERENT HEIGHTS ABOVE GROUND

In the photograph, jack pine cones are shown stapled to a post at various distances above the ground. It can be seen that the closer the cones are to the ground, the greater is the degree of opening, and those in direct contact with the surface are completely open.

The variations in degree of opening are due to the higher air temperatures near the soil surface compared with the temperatures at greater elevations. On warm clear days the temperature at the ground surface is often thirty degrees higher than it is six inches above the surface.

The cones were collected and set in place on July 13, 1938. On July 21, the lowest cones were fully open. The photograph was made on September 10, 1938.

This simple but very instructive experiment shows that the closeness with which slash is lopped and the manner in which it is scattered after logging will have a strong influence upon the promptness with which the seed is dispersed.

WHEN A FARMER CUTS HIS OWN TIMBER.....

There are many farmers in the Lake States who sell tie-timber stumpage, but few who run their own operations. There is one interesting case of a farmer located in Bohris Valley of Buffalo County, Wisconsin, which illustrates the advantage of the complete operation when the farmer is capable of doing his own logging and selling.

This man had about 1300 ties to dispose of. Prices offered by tie operators for stumpage ranged from 11 cents to 15 cents per tie. Acquainted with the devastating practices of



Cones opening at different elevations above the ground

other tie operators, he preferred to do the logging himself. This operation kept him and his sons busy during the winter months when they were otherwise unemployed, except in caring for farm livestock.

Felling and bucking costs amounted to 13 cents per tie cut. Two men, working 8 hours a day, made on the average 50 tie cuts together. One team and man skidded 100 tie cuts per day at a cost of 6 cents per tie. Ties were sawed on a portable mill at a cost of 10 cents per tie. The sawyer's wages were included in this figure. Ties were trucked to Fountain City, a 5-mile haul, at a cost of 4 cents per tie. Loading costs were $2\frac{1}{2}$ cents per tie. The ties were sold at an average price of 69 cents each, f.o.b.

Side lumber, amounting to 6,000 board feet, was obtained from the tie cuts at a cost of \$5 per M. This lumber was sold green at \$18 per M. Thirty-five cords of fuel wood was salvaged from tops and limbs and slab material, at a cost of \$1.25 per cord. This cordwood was sold at \$5.50 per cord.

These transactions may be summarized as follows:

Sales:	
1,300 ties, at 69 cents per tie.....	\$ 897.00
6,000 board feet lumber, at \$18 per M.....	108.00
35 cords fuel wood at \$5.50 per cord.....	192.00
Sales total.....	<u>\$ 1,197.00</u>

Operation costs:		
Felling	1300 ties at 13¢ per tie.....	\$ 169.00
Skidding	" " " 6¢ " "	78.00
Sawing (ties)	" " " 10¢ " "	130.00
Hauling	" " " 4¢ " "	52.00
Loading	" " " 2½¢ " "	32.00
Sawing (lumber)	6000 bd. ft. at \$5 per M.....	30.00
Cutting fuel wood, 35 cords at \$1.25 per M.....	44.00	
	Operation costs total.....	<u>\$ 535.00</u>

Sales.....	\$ 1,197.00
Operation costs.....	<u>535.00</u>
Net profit.....	\$ 662.00

This farmer, by handling the operation himself, secured all labor, excepting that required for sawing, within his own family. If he had sold stumpage to a tie contractor at 15 cents per tie, he would have realized \$195.00, plus what additional revenue he might have derived from salvaged fuel wood. As it was, he not only made more money but, exercising reasonable care, he also left his woodland in the best possible condition considering the volume of timber that was removed.

SQUIRRELS VS. BLACK SPRUCE

In an article entitled "Squirrels versus Jack Pine" in the September-October 1936 issue of the Research Digest, the reduction in height growth of jack pine caused by squirrels cutting back the terminal shoots was reported. Now, it appears that black spruce suffers from a similar attack (see photograph).



Foresters have frequently noticed and commented upon the peculiar appearance of the tops of old black spruce trees growing in swamps. Such trees usually have a very conspicuous constriction in the crown from one to five feet below the tip. Frequently there is an almost complete lack of twigs for one or two feet at the point of the constriction.

Examinations of freshly felled trees have led to the belief that this is caused by squirrels which clip great numbers of branchlets a short distance below the tip. Whether the squirrels cut off the twigs to obtain cones or for some edible portion of the branchlets such as the buds is not definitely understood, but the effect of the pruning is to keep the crown smaller in diameter at this point than nearer the tip.